



International Semester Frontières du Vivant (iFdV)

Undergraduate program « Frontiers in Life Science »
Université Paris Descartes
Center for Research and Interdisciplinarity
Fondation Bettencourt-Schueller

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What is it?

A semester of courses in interdisciplinary life sciences

Who are the teachers?

Top life sciences researchers, fond of innovative pedagogy

Who are the students?

Talented scientific students coming from various countries and scientific fields, who have completed at least two years of undergraduate studies

Why is it for you?

It is a unique opportunity to learn what is research in modern biology, and to train actively all your scientific skills. All courses are in english, but we are in the heart of Paris.

The undergraduate program “Frontiers in Life Science” (“Frontières du Vivant” - FdV) was created in 2011 as an undergraduate program of excellence in interdisciplinary life science, based on innovative pedagogical methods and learning through research. The program received the **MCE Awards for “innovative pedagogy”** in 2013 and is supported by the **UNESCO “Learning through Research” chair** and by the Fondation Bettencourt-Schueller. The program is hosted by the CRI institute (*Centre de Recherche Interdisciplinaire*) of Université Paris Descartes.

The international semester iFdV offers a unique opportunity to 20 international students to study in an interdisciplinary research-oriented environment in Paris, France. This semester is made for students highly motivated by science, who wish to develop and improve their scientific skills and better understand the world of research before starting a Master or PhD program.

Our ambition is to foster the development of the next generation of innovative and autonomous leaders, capable of collaborative work, efficient communication and critical thinking. We believe these skills are essential for future challenges in scientific fields, as well as in any field requiring problem-solving skills, creativity and responsibility.

Learning through and for research

The undergraduate FdV program offers a rare opportunity to explore the functioning, the challenges and the complexity of the research world. The skills and knowledge acquired through the courses are deepened even further through internships in research labs or through student research projects conducted in our undergraduate research lab. Our teaching team's goal is to develop research competencies in each student. In addition to our research-based courses, all undergraduate students benefit from numerous international conferences and workshops and from a close contact with interdisciplinary life science Master and PhD students.

Tell me and I will forget, Show me and I may not remember, Involve me and I will understand.
Native american proverb

An integrated interdisciplinary program

The iFdV semester consists of highly integrated modules that are carefully designed for an interdisciplinary investigation of biological systems. Interdisciplinarity in life sciences is explored at the interfaces between biology, physics and chemistry; biology, mathematics and computer science; biology and medicine. Scientific methodology is an integral part of training: our students examine ethical responsibility in science, practice experimental design and analysis of research articles, and develop project management, writing and presentation skills. These concepts do not stay theoretical; they are introduced and reinforced through group discussions, hands-on activities and research projects.

The proof that you know something is that you are able to teach it
Aristote

A community of learners

To maximize the fruitful interactions and emergence of novel interdisciplinary ideas, our undergraduate program welcomes students from diverse scientific backgrounds. Even though the majority of our students have shown prior interest in life science, we encourage students with backgrounds in computer science, mathematics, physics and chemistry to contribute to our program. The mixing of students from various backgrounds is essential in creating a learning environment where each student can contribute with their own speciality, and can tutor those who need help in that field. We stimulate learning interactions through teamwork and peer-to-peer evaluations, as one of the hallmarks of modern science-related work.

In the long history of humankind, those who learned to collaborate and improvise most effectively have prevailed
Charles Darwin

iFdv curriculum

The iFdV modules are taught in English and carry 30 ECTS points (European credit system). They are divided into two groups of modules. The first group gather courses that cover different topics of research in interdisciplinary life sciences. The second group aims at immersing the students into the design of scientific activities, from finding research problems to communicating

scientific knowledge. As in most top universities in the world, we propose an intensive and demanding working experience that should lead the students to improve efficiently their knowledge and skills, while maintaining the pleasure of learning. We employ multifaceted continuous evaluation in all modules.

The iFdV semester begins on February 9th and ends on June 19th 2015

INTERNATIONAL SEMESTER PROGRAM



MODULES A – diversity of interdisciplinary life science (150h)

A1	<p>Frontiers of immunology (30h)</p> <p>Claire Hivroz</p> <p>Vassili Soumelis</p>	<p>Modern immunology is a complex interdisciplinary science. In this course, the students will discover how physics can help understanding pathogen recognition and elimination at a molecular and physical level, and how mathematics and computer science help link the cellular level to the physiological response. The student will then see the multiple scales that start with atomic forces and ends with medical strategies.</p>
A2	<p>Physical and chemical limits of living systems (30h)</p> <p>Nathalie Stroeymeyt</p> <p>Vincent Dahirel</p>	<p>Interface between biology, physics and chemistry will be a theme of this module. The students will follow different steps of a research investigation of the influence of chemical and physical constraints on the biology of amphibious insects, which can walk on water, dive with bubbles, sense waves. The research project will include designing physical and chemical theories, and making sensors to study insects in the field.</p>
A3	<p>Diversity of microorganisms</p>	<p>This intensive two-weeks module will cover topics in modern microbiology, including microbial ecology and genomics, microbe</p>

	(30h) Tamara Milosevic	interactions with plants, microbial symbiosis and human microbiota, as well as interactions between microbes and the immune system, epidemics, vaccines and antimicrobials. The students will be mostly in a modern research laboratory, and they will design their own project.
A4	Systems ecology (30h) Minus Van Baalen	The systems ecology module explores the interdisciplinary fields of ecology and evolution using an approach that focuses on how mathematical and computer models can serve as tools to integrate knowledge and generate hypotheses. Topics will be chosen based on the interests of students, and may include exploration of ecosystems from global to cellular scale, population ecology and coevolution, climate change and biodiversity.
A5	Advances in neuroscience (30h) Maéva Vignes Claire Ribault	This intensive module will take an interdisciplinary look at neuroscience. Through interactive courses, practical courses as well as meetings with researchers in diverse fields, the students will discover the latest developments in neuroscience research and methodology. The students will notably explore modern neuroscience topics such as neuronal development and degeneration, cognition and artificial intelligence.

MODULES B – modern science research methods (150h)

B1	Research design (80h) Livio Riboli-Sasco Claire Ribault <i>(Atelier des Jours à Venir)</i>	The aim of this module is to provide practical and critical skills for performing a research project. Students will perform a short « preliminary research project », aiming at analysing the relevance and feasibility of a medium-term research project (~6 months), such as the one in which they would engage in a master internship. In this preliminary exploration, students will first investigate the existing knowledge through bibliographic search and discussions with researchers from the field. Then, they will design and perform experiments, followed by quantitative data analysis and interpretation. Finally, they will conclude about the difficulties, challenges and potential outcome of the medium-term research project, and will make proposals to reframe or improve it. The module will provide guidance in how to reduce to minimum the experimental investigation in order to still provide enough proof of concept for further research. Students will learn to perform a kind of frugal research.
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B2	Science communication (30h) François Taddéi	The students will learn how to read and analyse research articles, as well as how to propose relevant continuation of research. They will also be introduced to another form of communication, with the construction of an online course about evolution that gathers ideas from all courses from module A.
B3	Programming and modelling for biology (40h) Omar Awile	This module will introduce programming applied to biology. The students will learn how to read code and understand algorithms. They will also learn how to translate a problem description into code allowing them to simulate a model and/or analyse and visualize their data.

APPLICATIONS

The applicants should have completed two years of undergraduate studies in formal or natural sciences and provide us a detailed account of relevant curricular and extracurricular activities. The application must therefore include a CV, a motivation letter and a transcript of academic records, including a proof of enrolment in your home university for the year 2013/2014. Recommendation letters and additional documents are welcomed, but not mandatory.

Applications for iFdV 2015 are being accepted until **November 30th 2014** (23h59 CET). **The application and all questions regarding the program must be sent to the following email address:** international@fdv-paris.org

Contact person:

Gaëlle Chevalon

International cooperation development, FDV program

Email: international@fdv-paris.org

Phone: 0033 1 44 41 25 28